Journal of University of Babylon for Pure and Applied Sciences, Vol. (28), No. (3): 2020
Online ISSN: 2312-8135, Print ISSN: 1992-0652

Biostratigraphy of Qamchuqa Formation in Jambur Oil Field in Kirkuk Area

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Article Information
Submission date: 30 / 9/ 2020
Acceptance date: 20/ 10/ 2020
Publication date: 31/ 12/ 2020

Abstract

The Qamchuqa Formation has been studied in three wells (Ja-15, Ja-20, Ja-22) within Jambur oil field, North East of Iraq . Three hundred and thirty five thin sections have been studied by polarizing microscope in order to determine fossils and biozones. Thirty seven species of benthic foraminifera were recognized.In addition to following fossils that recognized in Qamchuqa Formation : Calcareous algae – *Coptocampylodon fontis*, Rudist fragments ,Pelecypods Gastropods , Mollusks , Brachiopod , Ostracods shells , Echinoid fragmendes , Coral and Algea .

Five biozones were observed, they are: ***Praeorbitolina cormyi – Palorbitolina lenticularis*** - concurrent Zone (of Early Aptian), ***Mesorbitolina parva*** - Range Zone (of Middle Aptian age)***, Mesorbitolina texana*** - Range Zone (of Late Aptian – Early Albian,), ***Mesorbitolina subconcava*** - Range Zone (latest early Albian) and ***Orbitolina sefini*** - Range Zone (of Late Albian). The age of Qamchuqa Formation has been distinguished according to these biozones, to be as (Aptian-Albian).

Keywords:- Qamchuqa Formation, Biostratigraphy, Foraminifera, *Orbitolina*, and Jambour oil field.

Introduction

Qamchuqa Formation is a shallow water carbonate with widespread distribution as an outcrop (North and Northeast Iraq) in the High Folded Zone and in the subsurface of the Foothill Zone toward South Iraq, extending to Arabian Gulf" [1]. The Qamchuqa Formation depicts one of the major reservoirs all over Zagros foreland basin . Qamchuqa Formation in current study represented by upper and lower Qamchuqa Formation separated by Upper Sarmord (Batiwah) tongue deposited during the Early Aptian – Late Albian within the Zagros foreland basin, Upper Sarmord equivalent to Naher Omar, while the Upper Qamchqa represent the equivalent to the Mauddod Formation and lower Qamchuqa represent the equivalent to Shuaiba Formation"[2]

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Online ISSN: 2312-8135, Print ISSN: 1992-0652

Location of study area

The study area is situated within Kirkuk Governorate Northeastern Iraq (Fig.1). This area occurs within the Zagros foreland basin, confined by the Zagros Mountains on the Northest and by the Arabian Shield on the southeast, and consists of linear and high amplitude folds that trend in a northwest-southeast direction. These folds affect the whole Mesozoic-Cenozoic series[3]. Jambour structure located about 40 km south-southeast of Kirkuk Governorate, and 16 km south west of the extension of the Kirkuk structures strike line [4] .The three wells that chosen for this study (Ja-20 , Ja-22 , Ja-15) located on the Northwestern nose of the Jambur structure of the following (Table 1). Three hundred and thirty five thin sections from cores of the studied wells (Table-2), these were provided by Department of Geology - College of science - university of Baghdad.

Table 1 : geographic coordinates of Jambour wells (UTM system WGS84) and thickness of Qamchuqa Formation

Well No.	Geographic co –ordinate of well		Thikness (m)
	E	N	
Ja-15	446828.13	3901010.44	255
Ja-20	447134079	3899647.25	157
Ja-22	445328.80	3901816.01	250

Table 2: details of the three selected wells

well	Depth (m)	Number of thin sections
Ja-15	3235-2980	85
Ja-20	3195-3038	100
Ja-22	3225-2975	150

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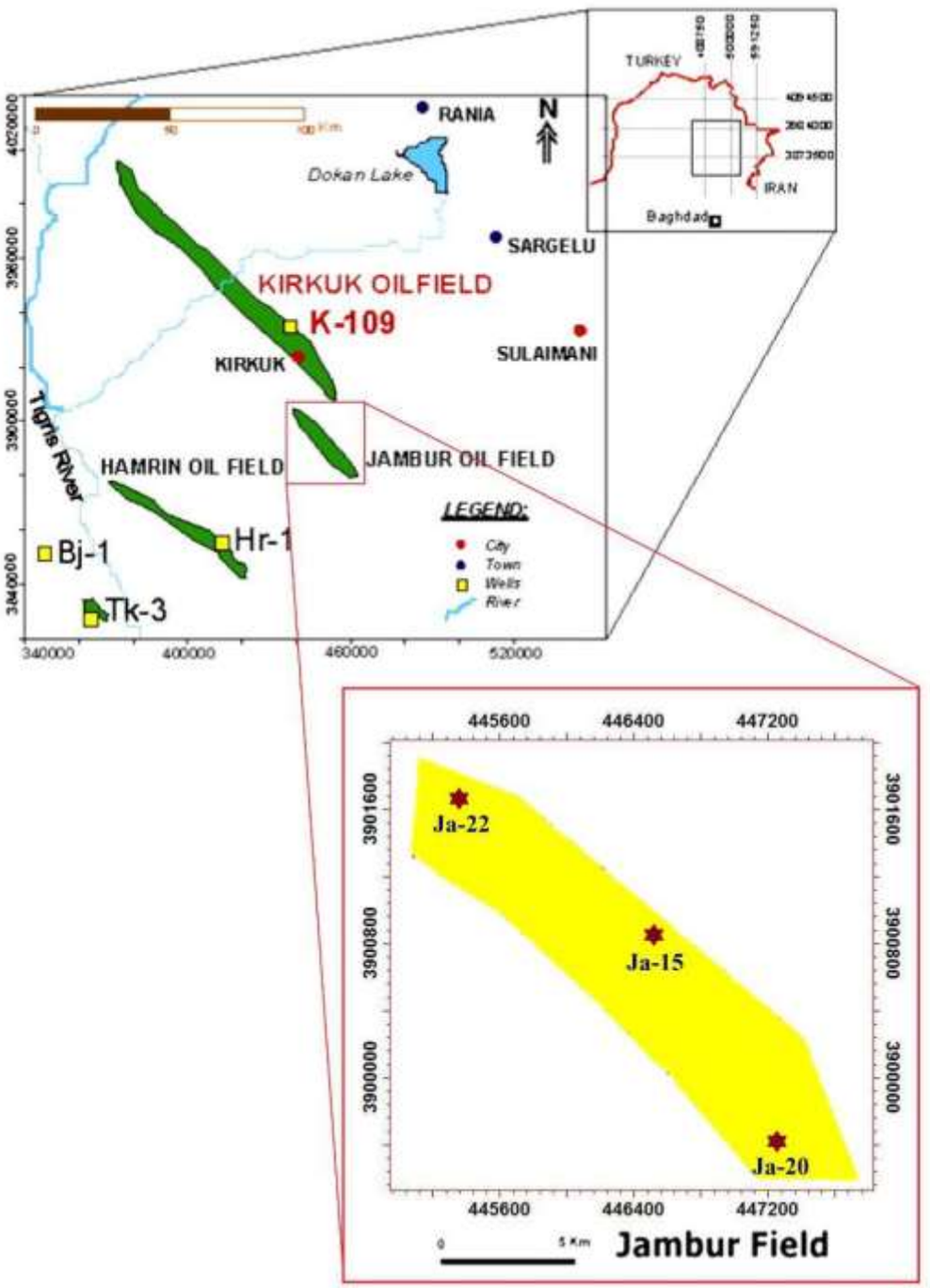
Online ISSN: 2312-8135, Print ISSN: 1992-0652



(Fig. 1) location map of studied area shows oil field and borehole location.

Journal of University of Babylon for Pure and Applied Sciences, Vol. (28), No. (3): 2020
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Stratigraphy and tectonic setting

The Qamchuqa Formation depicts one of the main rock units of Iraq. It consist of massive to thickly bedded limestone and dolomite, which are quite hard and predominantly their color grey to dark grey. Bellen *el.al*. mentioned Both the upper and lower parts of Qamchuqa Formation range in age from hauterivian to albian [5]. So as to understand the condition of sedimentation of Qamchoqa Formation , it is needful to be informed with the stratigraphic relations of this formation . This is achieved by the following review on the formation through the works of Wilson , Gaddo, Al-Naqib, Dunnington and Chatton and Hart. The Qamchuqa Formation divided in to lower unit of Barremian-Aptian age and an upper unit of Albian age [39].

Bellen *et.al*. mentioned the Qamchuqa Formation was originally believed to extend in to the Cenomanian because of the frequent occurrence of some species of the Orbitolina concava group[41].

The Qamchuqa Formation was described for the first time in (1950) by Wetezel [41] from Qamchuqa village (type locality), east of Dokan dam site to the northeast of Sulaimaniya city in northern Iraq. Furst adverted the upper and lower Qamchuqa Formations have been renamed Mauddud and Shuaiba Formations, respectively in the middle and southern parts of Iraq . also mentioned that, in Iran, the correlative formations are Dariyan (Aptian) and the Albian part of Sarvak Formation of the East Zagros Mountains [7] (Fig.2).

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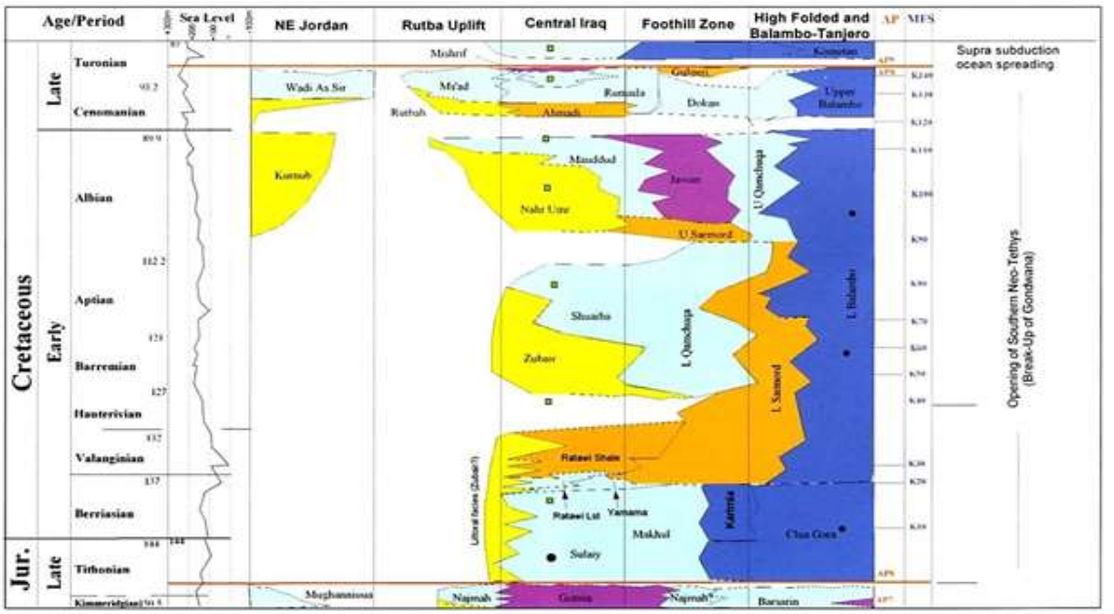
Online ISSN: 2312-8135, Print ISSN: 1992-0652



(Fig.2) Regional stratigraphic correlation of Lower Cretaceous units in Megasequence AP8 (Jassim and Goff ,2006)

The Qamchuqa rocks is part of the lower and middle cretaceous sedimentation cycles [8] and later slightly altered by chatton and haret. Two geological cycles have to be considered [6]:

1-The Ttithonian – Aptian cycle

2-The Albian cycle

The Qamchuqa Formation (Aptian –Albian) in the study area is represented by the Lower and Upper Qamchuqa separated by Upper Sarmord in northeastern parts of Iraq. The distribution of the Lower Qamchuqa Formation is very large and includes almost the whole area of the Stable and Unstable Shelf, affected by the Albian transgression. An exception is the shallow lagoonal basin in northwestern Iraq, to the northwest of Makhul (Makhul Subzone), where the formation is replaced by the lagoonal evaporitic Jawan. The main area of its distribution is the so called Qamchuqa ridge, coinciding witht he High Folded Zone (Fig.3) [9] .

The Upper Sarmord Formation occurs in the subsurface between Kirkuk in the East and Mosul in the West and separated from theBalambo basin by the Qamchuqa carbonate ramp situated on the High Folded Zone [7]. It consists of marls with neritic limestone beds. The lower contact of the formation in the East is gradational andconformable. In the West, the Upper

Sarmord Formation unconformablyoverlies the Najmah or Sargelu formations. The upper contact with theMauddud Formation is usually conformable and gradational [9].

The Upper Qamchuqa Formation is loctated on the Stable Shelf (apart from the N part of the Rutba-Jezira Zone), and in the Foothill and High Folded zones. It is thickest on the Qamchuqa Ridge of theHigh Folded Zone and the thickness of the formation decreases to the SE [9].The lower contact of the Lower Qamchuqa is conformable with the Ratawi, Yammama and Lower Sarmord Formations, except in the arealocated to the northeast of the study area is unconformable with Garagu Formation by the Late Valanginian Unconformity [9].To the Northeastern the Lower Qamchuqa Formation passes into the Balambo Formation in the SW parts of the Balambo-Tanjero Zone. To the westand Southwestern the Shuaiba Formation is present everywhere excepton the Stable Shelf west of the Salman Zone [7] The upper boundary of the formation is usually conformable inNorthern and Northeastern Iraq with the upper Sarmord Formation. Inthe Southeastern part of the Foothill Zone, in the Mesopotamian Zone, and along the margins of the Salman Zone the upper contact is an unconformity [44].The lower contact of the Upper Qamchuqa Formation is conformable and gradational with the Lower Sarmord, Nahr Umr or Lower Balambo formations. The upper contact is marked by a break and is either nonsequential or unconformable; it is an unconformity in N Central, Nand NE part of Iraq. The Upper Qamchuqa here is directly overlain bythe Turonian formations (Dokan), for example in the Makhul and theMileh Tharthar areas. The upper boundary of the formation is also marked by an unconformityin the Rutba Subzone [9].

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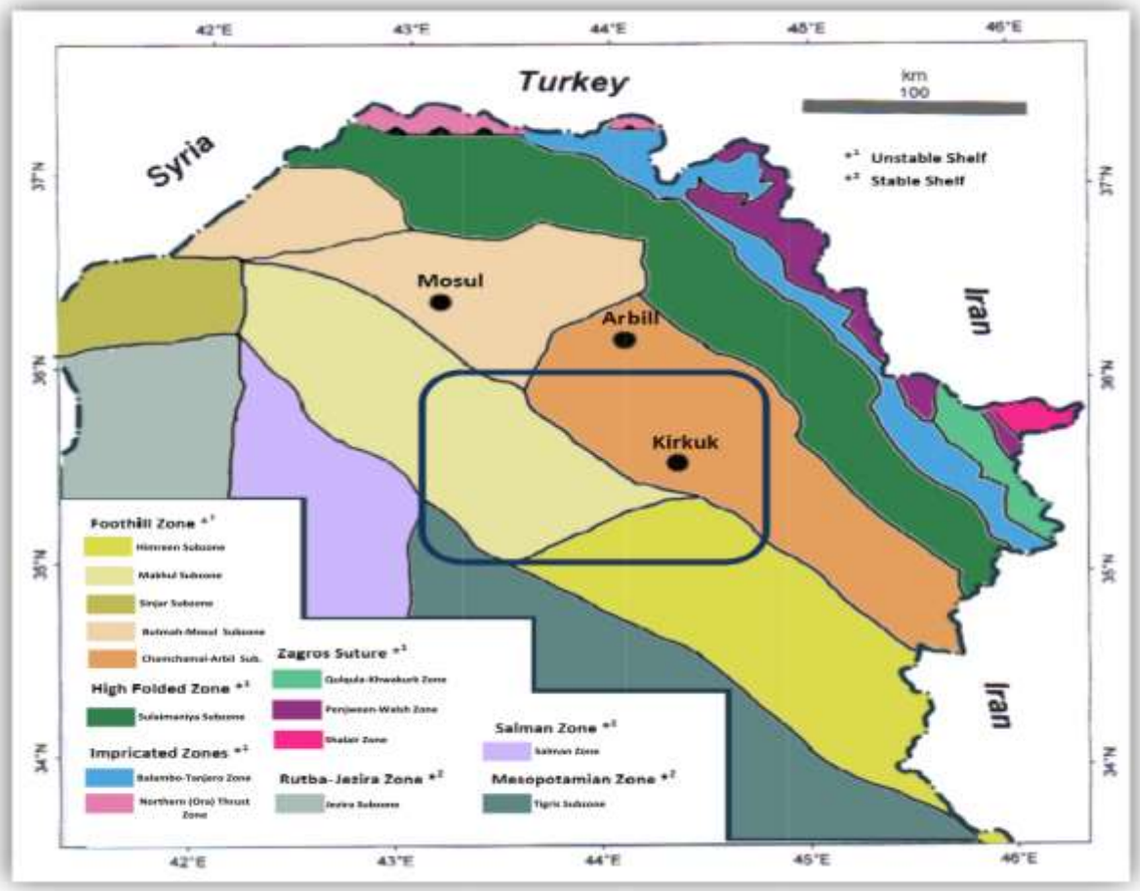
Online ISSN: 2312-8135, Print ISSN: 1992-0652



(Fig.3) Tectonic map North of Iraq (Jassim and Goff ,2006)

Biostratigraphy of Qamchuqa Formations at well Ja-15

The following microfauna are identified in the sediments of this formation at Ja–15 (Fig.4) :

Mesorbitolina texana (Roemer, 1849), Pl.A (Fig.1),*Orbitolina* sp. Pl.A (Fig.2), *Mesorbitolina sub concave* (Leymerie, 1878*)*, PL.A (Fig.3), *Iraqia simplex* PL.A(Fig.4), *Orbitolina sefini* (Henson,1948) Pl.A (Fig.5) , *Simplorbitolina deltoidos* sp. nov. Pl.A(Fig.6), *Paleodictyoconus* sp.1 Pl.A(Fig.7), *Dictyoconus algeria*nus Pl.A(Fig.8), *preachrysalidina* sp Pl.A (Fig.9), *Nezzazata* picardi Pl.A (Fig.10), *Nezzazata conica* (Smout) Pl.A (Fig.11), *Quinqueloculina* sp. Pl.A (Fig.12), *Triloculina* sp Pl.B (Fig.1), *Nummoloculina* sp Pl.B (Fig.2) , *Nezzazata picardi* Pl.B (Fig.3), *Nezazzata gyra* Pl.B (Fig.4),*Charentia cuvillieri* Pl.B (Fig.5), *Spiroloculina* sp. Pl.B (Fig.6), *Miliolids* Pl.B (Fig.7), *Dabarina hahouneresi* Pl.B (Fig.8) , *Chrysalidina* sp. Pl.B(Fig.9) .

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In addition to the following fossils:- Rudist fragments Pl.B (Fig.10), Mollusca Pl.B (Fig.11), Echinoid fragments , Ostracod shells Pl.B (Fig.12) and Algae .

Biostratigraphy of Qamchuqa Formation at well Ja-20

The following microfauna are identified in the sediments of this formation at Ja–20 (Fig.5) :

Mesorbitolina texana (Roemer, 1849), Pl.C (Fig.1)**,** *Praeorbitolina cormyi* Pl.C (Fig.2), *Palorbitolina lenticularis* Pl.C (Fig.3), *Mesorbitolina parva* Pl.C (Fig.4), *Simplorbitolina manasi* Pl.C (Fig.5), *Iraqia simplex* (Hensun, 1948) Pl.C (Fig.6), *Paleodictyoconus arabicus* Pl.C (Fig.7), *Quinqueloculina* sp. Pl.C (Fig.8), *Triloculina* sp. Pl.C (Fig.9), *Nummoloculina* sp. Pl.C (Fig.10), *Spirolectammina* sp. Pl.C (Fig.11), *Textularia* sp. Pl.C (Fig.12), *Nezazzata simplex* (Omara,1956), Pl.D (Fig.1), *Nezzazata picardi* Pl.D (Fig.2), *Choffatila* sp Pl.D (Fig.3), *Conulina pavonia* Pl.D (Fig.4), *Dabarina hahounerensis* sp. Pl.D (Fig.5), *Charentia* spp. Pl.D (Fig.6) .

In addition to following fossils : Calcareous algae – *Coptocampylodon fontis* Pl.D (Fig.7), Rudist fragment Pl.D (Fig.8), Pelecypods pl.D (Fig.9), Gastropods Pl.D(Fig.10), Mollusca Pl.D (Fig.11), Brachiopods Pl.D (Fig.12).

Biostratigraphy of Qamchuqa Formation at well Ja-22

The following microfauna are identified in the sediments of this formation at Ja–22 (Fig.6):

Mesorbitolina texana (Roemer, 1849) , Pl.C (Fig.1)**,** *Mesorbitolina sub concave* Pl.A (Fig.3), *Orbitolina sefini* (Henson, 1948), Pl.A (Fig.5), *Iraqia simplex* (Henson) Pl.C (Fig.6), *Simplorbitolina deltoidos* Pl.A (Fig.6), *Paleodictyoconus arabicus* Pl.C (Fig.7), *Quinqueloculina* sp. Pl.C (Fig.8), *Spiroloculina* sp. Pl.B (Fig.6), *Triloculina* sp. Pl.B (Fig.1), *Nezazzata* sp. , *Nezzazata gyra* Pl.B (Fig.4), *Nezzazata conica* Pl.A (Fig.11), *Spirolectammina* sp. Pl.C (Fig.11), *Choffatela* sp. Pl.D (Fig.3), *Dabarina hahounerensis* sp. Pl.D (Fig.5). In addition to the following fossils: Rudist fragment Pl.D (Fig.8), Pelecypods Pl.D (Fig.9), Mollusca pl.D (Fig.11), Ostracods Pl.B (Fig.12).

Biozones of Qamchuqa Formation

The Biostratigraphical zones of this current study depends on benthonic foraminifera**,** The definitions of these biozones determined according to stratigraphic distribution of these foraminifera (Fig.4, Fig.5 , Fig.6), five biozones are distinguished , They are :

1- *Praeorbitolina cormyi – Palorbitolina lenticularis* - concurrent Zone

This concurrent zone is identified depending on the range of extension of part of the two species. This zone was determined with accordance of the first appearance of the species *Praeorbitolina cormyi* as a lower limit and the disappearance of *Palorbitolina lenticularis* as the

upper limit. These species ***Praeorbitolina cormyi*** and ***Palorbitolina lenticularis*** found in Lower Qamchuqa Formation"(Fig.5) , the thickness of this zone is 45m at Ja-20.

-Age of the *Praeorbitolina cormyi* – *Palorbitolina lenticularis* - concurrent Zone:

The age of this zone is recorded to be of Early Aptian , depending on Schroeder (1975) who mentions that two species are located at Aptian. Also these two species were recorded from strata belonging to the Barremian – Early Aptian age in other countries .The age and location of each species has recorded by many researcher from different countries are given below.

The species ***Praeorbitolina cormyi*** is recorded to be found in strata belonging to Barremian – Early Aptian age in each of the following countries :

Early Aptian in Bou Saada (Ain Diss) in Algeria [10],Barremian- Aptian boundary of Esfahan, centeral Iran [11], Early Aptian in southwest Sardinia in Italy [12], Early Aptian in Forua Spain in (province Vizcaya) [13], this species is identified for the first time of Aptian in Iraq. It came from Zubair Formation [14]

The species ***Palorbitolina lenticularis*** is recorded to be found in strara belomging to Late Barrimian –Middle Aptian age in each of the following countries:

Late Barremian - Early Aptian (=Bedoulian) in Kef Hahouner in Algeria [15], Late Barremian - Early Aptian (=Bedoulian) in the whole Fore-Balkan and Moesian platform in Bulgaria [16], Latest Barremian in Verdon, Colvert and St.Nizier du Moucherotte (province Isere); Earliest Late Aptian (=Gargasian)in Le Rimet near Grenoble (province Isere) and Perthe du Rhone in France [17], Late Barremian - Aptian at platforms of southern France [18], Middle Barremian of mountain Pellegrino in Italy [19] , Early Aptian in Bari, Puglia in Italy [20], Early Aptian of Ras Sharwayn.in Yemen [21], Early Aptian in Iraq, this species was identified from Garaggu Formation [22], and from the lower part of Qamchuqa Formation of Tel Hajar well-1 [18], also this species is recognized from the Zubair Formation and from the Lower Sarmord Formation [14] .

2- *Mesorbitolina parva* - Range Zone

This Range zone was determined with accordance of the first appearance of this species as a lower limit and the disappearance of it as the upper limit. The lower limit of this zone was associated with the latest appearance of ***Palorbitolina lenticularis***, while the upper limit was recognized by the appearance of ***Mesorbitolina texana*.** This species is recorded from Lower Qamchuqa Formation (Fig.5), thickness of this zone is 43m at Ja-20.

Journal of University of Babylon for Pure and Applied Sciences, Vol. (28), No. (3): 2020
Online ISSN: 2312-8135, Print ISSN: 1992-0652

Age of *Mesorbitolina parva* - Range Zone

Douglass mentioned that this species was found at only one horizon in the Playas Peak Formation in new Mexico of Middle Albian age [24], in this current study, *Mesorbitolina parva* has been recognized in Lawer Qamchuqa of Middle Aptian age. also the a ccurrences of this biozone were recorded in Aptian- Middle Albian by a number of researchers such as :

Middle Albian , in the upper parts of Mural limestone (Arizona), Playas peak (New Mexico) and Glen Rose (Texas) formations [24], Late Aptian, in western Slovnia, Central Croatia, Trnovskigozd and slunj in Yugoslavia .its extends to the base of Albian when it is associated with *Mesorbitolina texana*, and dropped to Early Aptian when it is transfer to *Mesorbitolina Lotzei* [25], Apian, in Ain Yagout in Algeria [10], Early Aptian - Late Aptian passage of Dahr el Baidar (between Beirut and Zahla) [26], Early Aptian Bedoulian- Gargasian of Villarroya de los Pinaryes (Teruel province) in spain [27], Late Aptian of Cixerri Formation ,southwest Sardinia in Italy [7], Gargasian of Jura platform in France ([28], *Mesorbitolina parva* has been recognized of (middle Albian) in Iraq in the Shuaiba Formation in the following wells Kirkuk-109, Khabaz-1, Qara chuq-1east Baghdad -2 , Samara-1 ,merjan-1, Musayab-1 , Rumaila-21 , Tuba-1 and Dujiala-1[14].

3- *Mesorbitolina texana* - Range Zone

This zone was determined with accordance of the first appearance of this species as a lower limit and the disappearance of it as the upper limit. The lower limit of this zone was associated with the latest appearance of ***Mesorbitolina parva***, while the upper limit was recognized by the appearance of ***Mesorbitolina subconcava*.** The occurrence of this zone in Qamchuqa Formation and Upper Sarmord tongue (Fig.4,5,6), thickness of this zone is 73m at Ja-15,68m at Ja-20, 141m at Ja-22.

Age of *Mesorbitolina texana* - Range Zone

This zone appears in the late stage of late Aptian and extends to cover most early Albian [29], In this present study, this zone most probably represents to Late Aptian – Early Albian ,the accurrences and age of this biozone were recorded by a number of researchers such as :-

Late Aptian, in Lebanon [30], Late Aptian – Early Albian in the lower part of Glen Rose and lower part of Trinity group in USA , Late Aptian–Early Albian, in USA [31], Late Aptian – Early Albian, in Spain [27], Upper Aptian, in Iran [32], Late Albian, in Greece, association with ***Paracoskinolina bronnimanni*** and ***Valanchella aercourii*** [33], Albian age, in Mexico [10], Late Aptian age, in Italy [12], Basal part of the Middle Albian, in Portugal [34], Early Albian, in Yemen [21], In Iraq these species were distinguished of Albian age in lower parts of Nahr Umr

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Formation and the Upper parts of Shua'aiba Formation in the following wells; Khabaz-1, Kirkuk-109, Qara Chuq-1, Samara-1, East Baghdad-2, Kifil-1, Merjan-1, Musayib-1, Rumaila-21, Dujiala-1 and Tuba-1[14].

4- *Mesorbitolina subconcava* - Range Zone

This zone was determined with accordance of the first appearance of this species as a lower limit and the disappearance of it as the upper limit. The lower limit of this zone was associated with the latest appearance of ***Mesorbitolina texana*** , while the upper limit was recognized by the appearance of ***Orbitolina sefini.*** In current study this zone identified at Upper Qamchuqa Formation and Upper Sarmord tongue (Fig.4,6). Thickness of this zone is 20m at Ja-15 , 54m at Ja-22 .

-Age of *Mesorbitolina subconcava* - Range Zone

The age of this species recorded as Late Aptian [35], Later Jafferzo and Schroeder, extended in age to the Middle Albian [36]. In current study the age of this zone recorded as latest early Albian. The type locality of this species is France and the type horizon is Early –Middle Albian [37].The age and occurrence of this species in other contries are :

Early Albian, in Yugoslavia (Bosnia) [25], Late Aptian (top)–Late Albian, in France [31], Late Aptian of Qalana in Yemen [21], Late Aptian, in France association with ***Mesorbitolina texana*** [36], Late Albian, in Spain, in association with ***Mesorbitolina aperta*** with the presence of pyritized ammonites [37], Early Albian, in Spain, in association with ***Simplorbitolina manasi*** Ciry and Rat [38], Late Albian, in Spain (Province Valencia) [39], Late Albian, in the lower part of Glen rose limestone, in USA (Texas) [24], Late Albian, in Montague of Vertes, Hungary [40], Albian age, in Iraq [14].

5- *Orbitolina sefini* - Range Zone

This biozone is defined by the first and last appearance of *Orbitolina sefini*. the lower limit of this zone is set with accordance to the last appearance of *Mesorbitolina sub concave* and the upper limit coincides with the disappearance of this spcies. In present study this zone distinguished at Upper Qamchuqa Formation (Fig.4,6). The thickness of this zone is 15m at Ja-15 , 55m at Ja-22 **.**

Journal of University of Babylon for Pure and Applied Sciences, Vol. (28), No. (3): 2020
Online ISSN: 2312-8135, Print ISSN: 1992-0652

-Age of *Orbitolina sefini* - Range Zone

This zone is located at Late Albian - Early Cenomanian boundary [29], in current study the age of this zone was determined to be Late Albian, Also the species *Orbitolina sefini* was recorded from strata belonging to the Albian- Cenomanian age in each of the following countries :

Late Albian, in Spain [41], Early Cenomanian, in Portugal [42], Cenomanian, in Sefin Dagh north Iraq [30], Albian of Mauddud Formation at southern Iraq [43], Late Albian- Early Cenomanian of Mauddud Formation southern Iraq [44], and Late Albian – Early Cenomanian, in Mauddud Formation [14].

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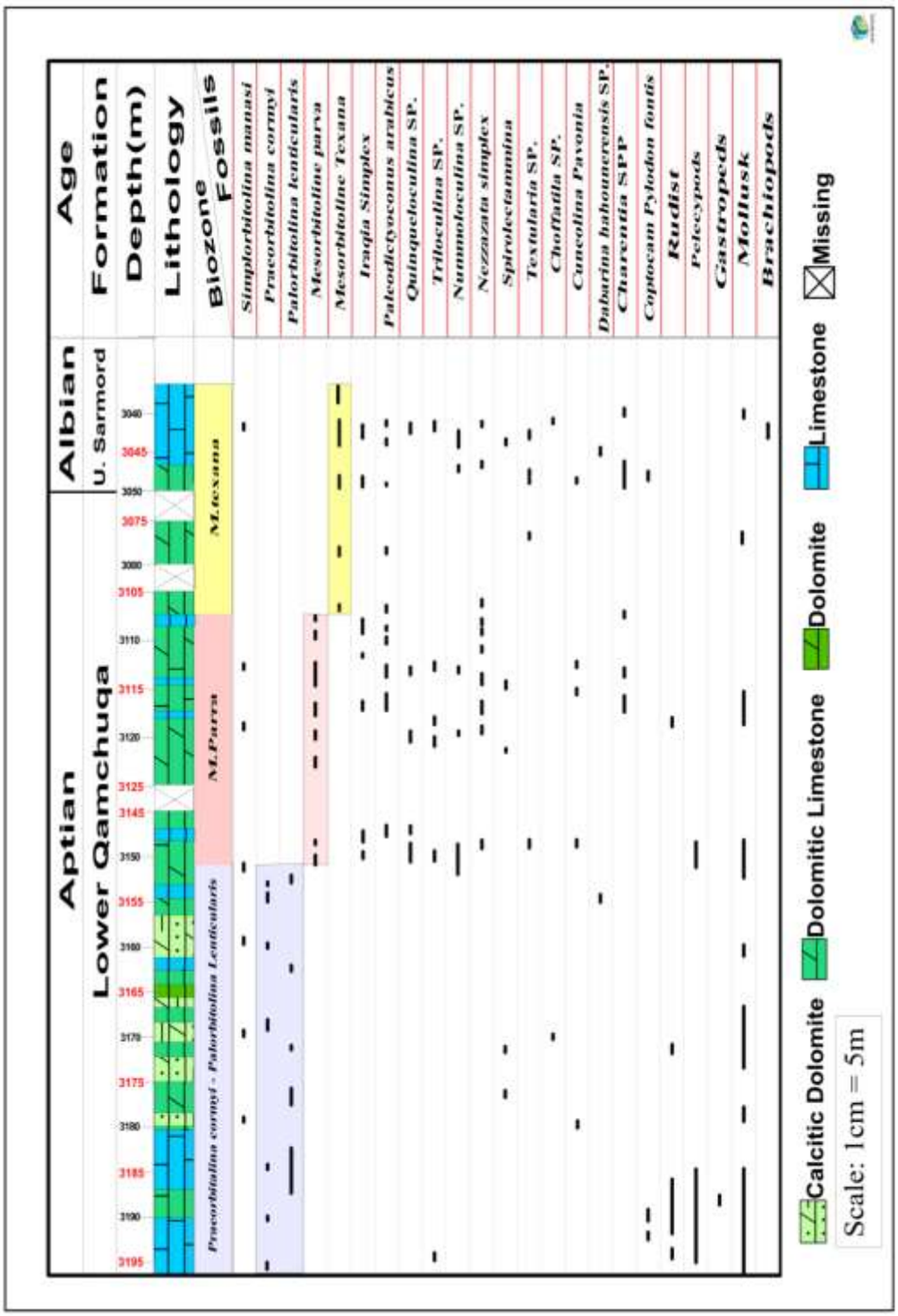

(Fig.5) Biostratigraphy of Qamchuqa Formation of well Ja-20

Journal of University of Babylon for Pure and Applied Sciences, Vol. (28), No. (3): 2020
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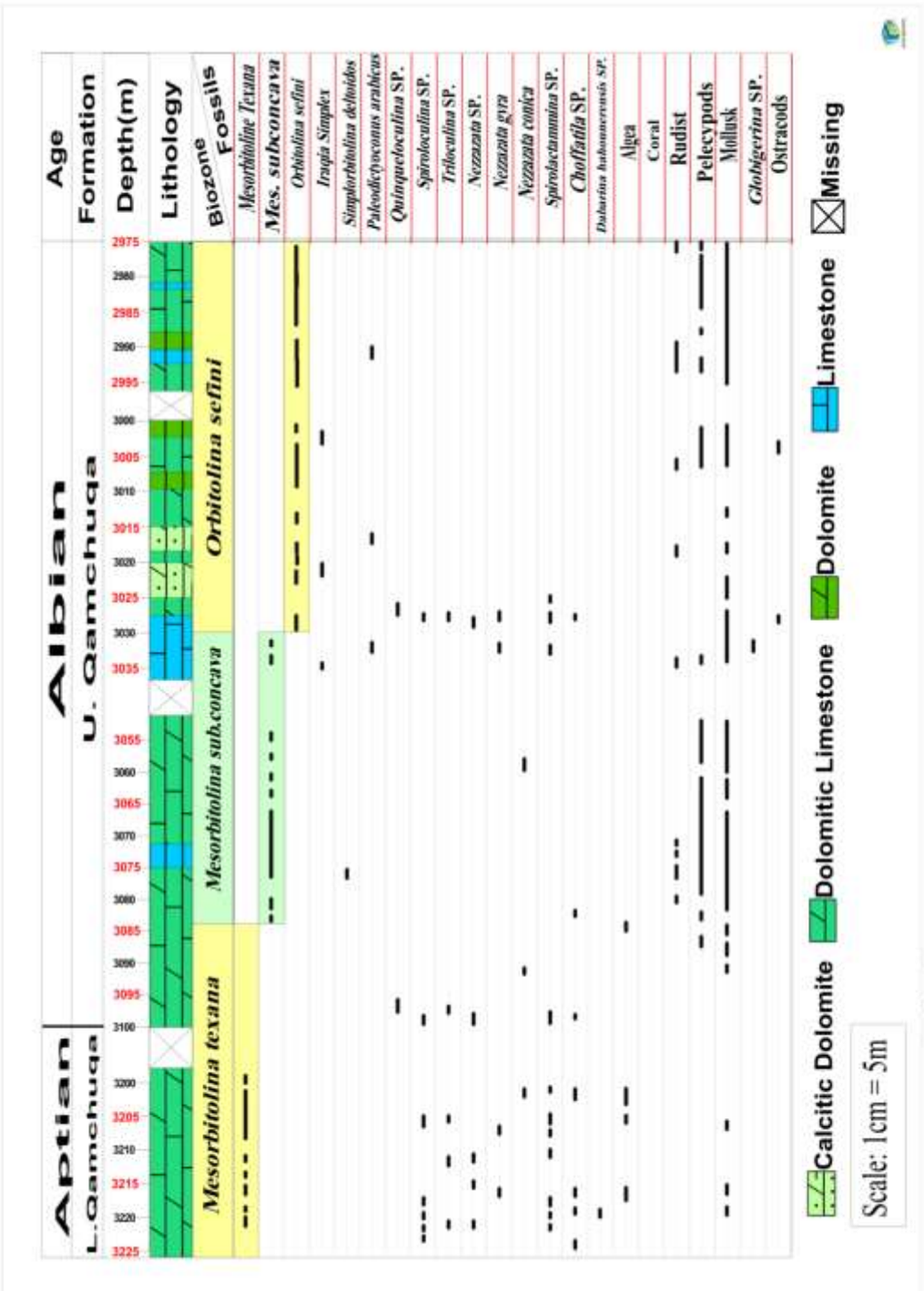

(Fig.6) Biostratigraphy of Qamchuga Formation of well Ja-22

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Online ISSN: 2312-8135, Print ISSN: 1992-0652

Plate - A -

Fig.1: *Mesorbitolina texana* (Roemer, 1849),Lower Qamchuqa axial section, Ja-*15* at depth (3084.5m)

Fig.2*:* *Orbitolina* sp. , Upper Sarmord formation, Ja-15 at depth (3014.8m)

Fig,3: *Mesorbitolina subconcava* ,Upper Sarmord ,axial section , well Ja-15, at depth (2996m)

Fig.4: *Iraqia simplex* , Upper Qamchuqa Formation, Ja-15,at depth (2990 m).

Fig.5: *Orbitolina sefini* (Henson),Upper Qamchuqa Formation, tangential section, Ja 15 at depth (2992m)

Fig.6: *Simplorbitolina deltoidos* sp., Upper Sarmord Formation, tangential section, Ja-15, at depth (3002m).

Fig.7: *Paleodictyoconus* sp.1, upper Sarmord Formation,oblique section, Ja-15 ,at depth (3004 m)

Fig.8: *Dictyoconus algerianus* , Upper Sarmord Formation , tangential section, Ja-15, at depth (3009m)

Fig.9: *Preachrysalidina* sp. , Upper Sarmord Formation, well Ja-15, at depth (3013.6m)

Fig.10: *Nezzazata picardi* , Lower Qamchuqa Formation, well Ja-15, at depth (3025.7m).

Fig.11 *Nezzezata conica* ,Lower Qamchuqa Formation, well Ja-15, at depth (2026.5)

Fig.12: *Quinqueloculina* sp ., upper sarmord, well Ja-15 , at depth (2994m).

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Plate - A -

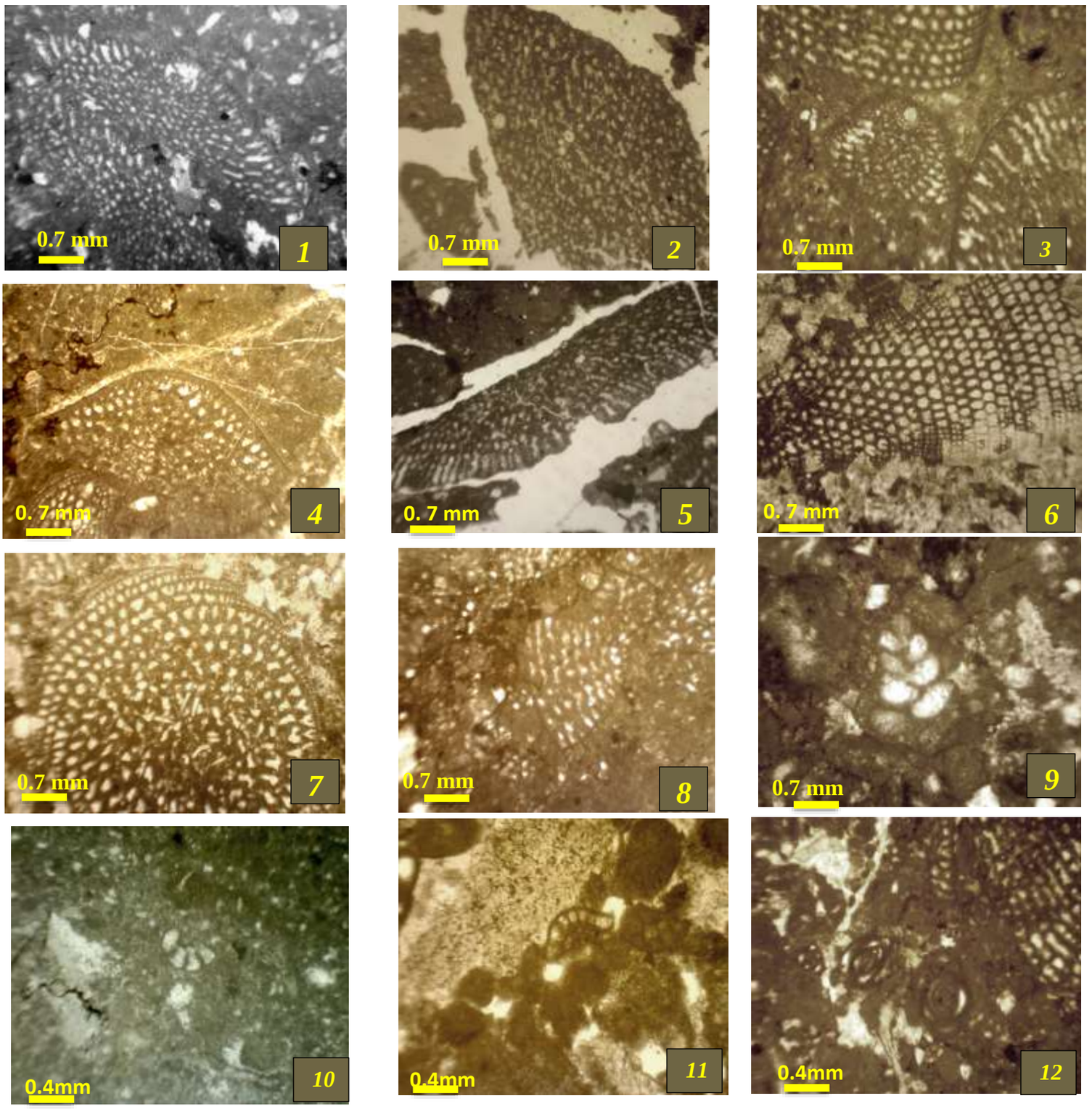

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Plate –B-

Fig.1*:* *Triloculina* sp., Upper Sarmord Formation , well Ja-15 at depth (2994m)

Fig.2: *Nummoloculina* sp. Upper Sarmord Formation, well Ja-15 at depth (3000m)

Fig.3 *: Nezzazata simplex* (Omara), Upper Sarmord Formation, well Ja-15 at depth (3010m)

Fig.4: *Nezzazata gyra* , upper Qamchuqa Formation, well Ja-15 at depth (2991m)

Fig.5: *Charentia cuvillieri*, Upper Sarmord Formation , well Ja-15 at depth (3006m)

Fig.6: *Spiroloculina* sp, Upper Sarmord Formation , well Ja-15 at depth (2996m)

Fig.7: *Miliolids* ,Upper Qamchuqa Formation, well Ja-15 at depth (2995m)

Fig.8: *Dabarina hahouneresis*, Upper Sarmord Formation , well Ja-15 at depth (3004 m)

Fig.9*:* *Chrysalidina* sp. Upper Sarmord Formation , well Ja-15 at depth, (3012m)

Fig.10: Rudist fragments, Upper Sarmord Formation, well Ja-15 at depth (3001m)

Fig.11: Mollusca, Lower Qamchuqa Formation, well Ja-15 at depth (3211m)

Fig.12: Ostracoda shell ,Upper Sarmord Formation, well Ja-15 at depth (3014m)

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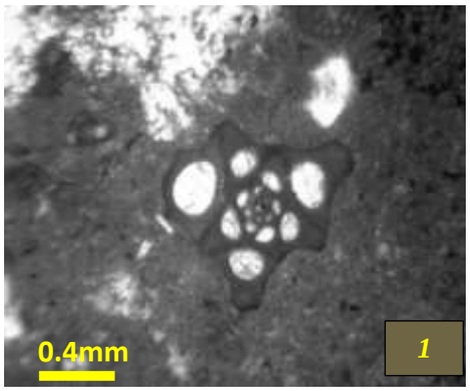
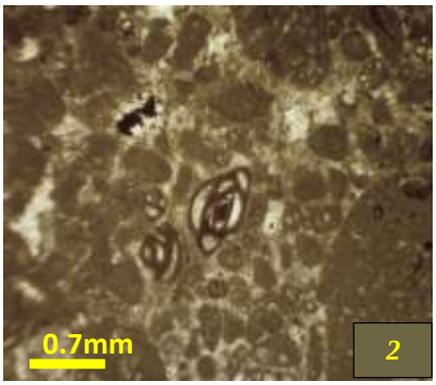
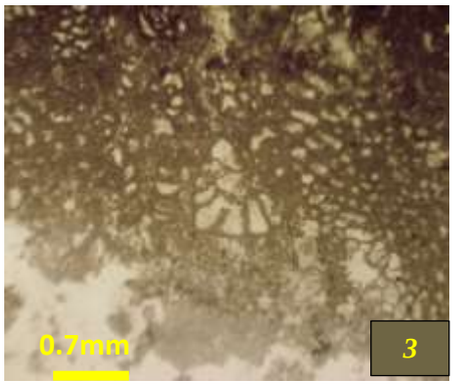
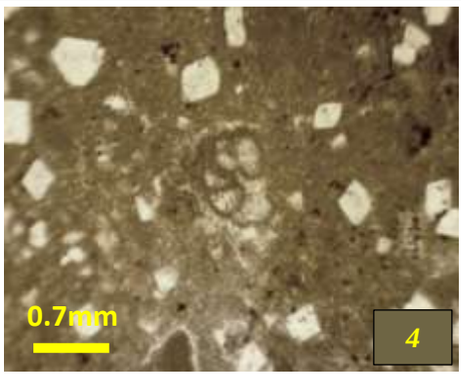
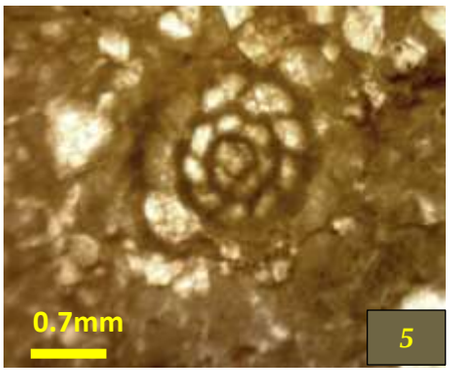
Plate - B -

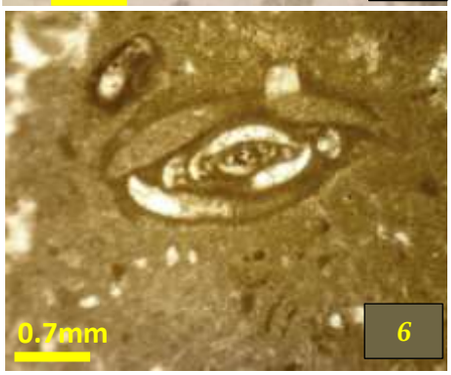


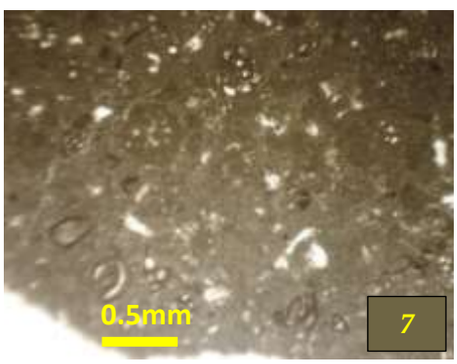


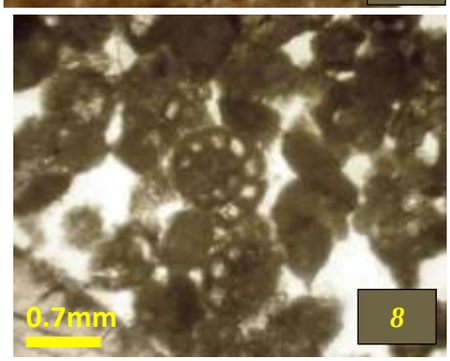


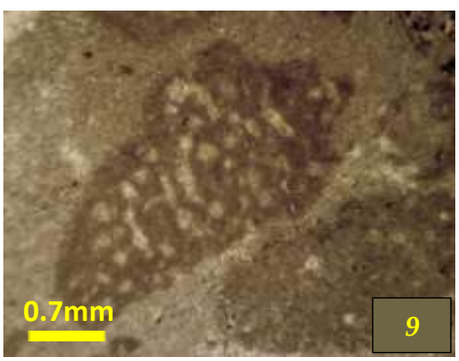


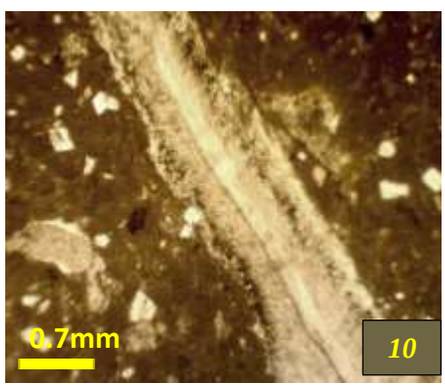


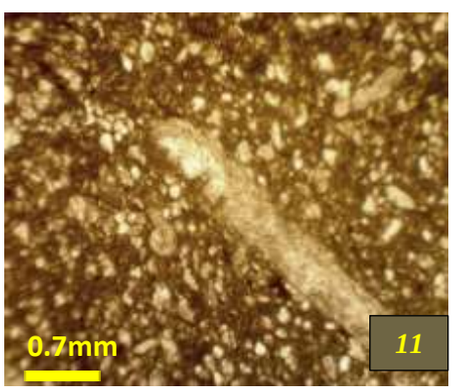


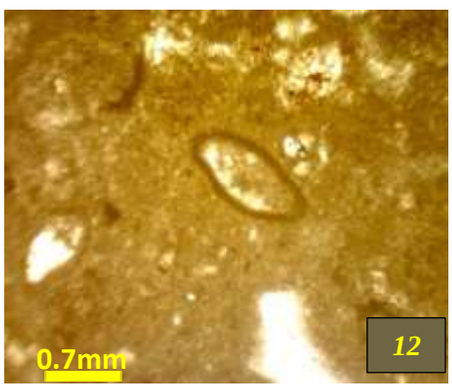












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Online ISSN: 2312-8135, Print ISSN: 1992-0652

Plate -C-

Fig.1: *Mesorbitolina texana* (Roemer, 1849), Lower Qamchuqa Formation, axial section,well Ja-20 at depth (3077m)

Fig.2: *Praeorbitolina cormyi* , Lower Qamchuqa Formation, axial section, axial section, well Ja-20 at depth (3152.3m)

Fig.3: *Palorbitolina lenticularis* , Lower Qamchuqa Formation, axial section, well Ja-20 at depth (3176m)

Fig.4: *Mesorbitolina parva*, Lower Qamchuqa Formation, axial section, well Ja-20 at depth (3113.3m).

Fig.5: *Simplorbitolina manasi* , Lower Qamchuqa Formation ,Transversal section , well Ja-20 at depth (3159m).

Fig.6: *Iraqia simplex* (Henson), Lower Qamchuqa Formation , well Ja-20 at depth (3148m).

Fig.7*:* *Paleodictyoconus arabicus* , Lower Qamchuqa Formation , well Ja-20 at depth (3110.8m).

Fig.8: *Quinqueloculina* sp. , Lower Qamchuqa Formation, well Ja-20 at depth (3121.8m).

Fig.9: *Triloculina* sp., Lower Qamchuqa Formation, well Ja-20 at depth (3050m).

Fig.10: *Nummoloculina* sp , Lower Qamchuqa Formation,well Ja-20 at depth (3047.4m) .

Fig11: *Spirolectamina* sp., Lower Qamchuqa Formation,well Ja-20 at depth (3170m).

Fig.12: *Textularia* sp., Lower Qamchuqa Formation, Ja-20 (3076.9m).

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Plate - C -

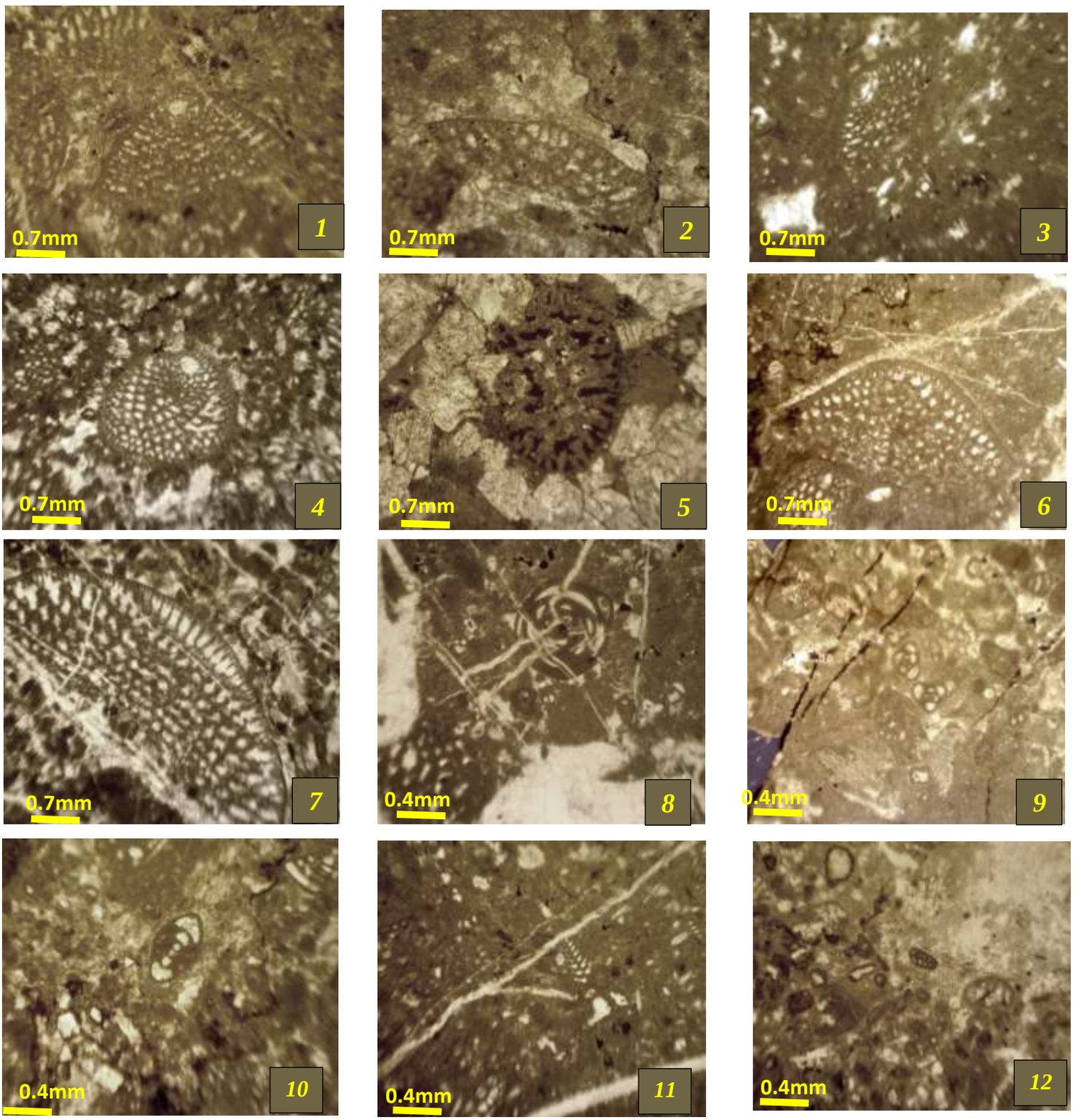

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Plate -D-

Fig.1: *Nezazzata simplex* (Omara,1956), Lower Qamchuqa Formation , Ja-20 at depth (3120.8).

Fig.2: *Nezzazata picardi* , Lower Qamchuqa Formation, Ja-20 at depth (3118.7m).

Fig.3: *Choffatila* sp. ,Upper Sarmord Formation, Ja-20 at depth (3042m).

Fig.4: *conulina pavonia*, , Lower Qamchuqa Formation , Ja-20 at depth (3116.5m)

Fig.5: *Dabarina hahounerensis* sp. Upper Sarmord Formation, Ja-20 at depth (3045.4m)

Fig.6: *Charentia* spp., Lower Qamchuqa Formation, Ja-20 at depth (3117.5m).

Fig.7: Calcareous algae – *Coptocampylodon fontis* , Lower Qamchuqa Formation, Ja-20 at depth (3193.7m).

Fig.8: Rudist fragment, Lower Qamchuqa Formation, Ja-20 at depth (3185m).

Fig.9: Pelecypods, Lower Qamchuqa Formation, Ja-20 at depth (3188m).

Fig.10: Gastropods, Lower Qamchuqa Formation , Ja-20 at depth (3188.6m).

Fig.11: Mollusks, Lower Qamchuqa Formation, Ja-20 (3190.9m).

Fig.12: Brachiopods, Lower Qamchuqa Formation, Ja-20 (3042 m).

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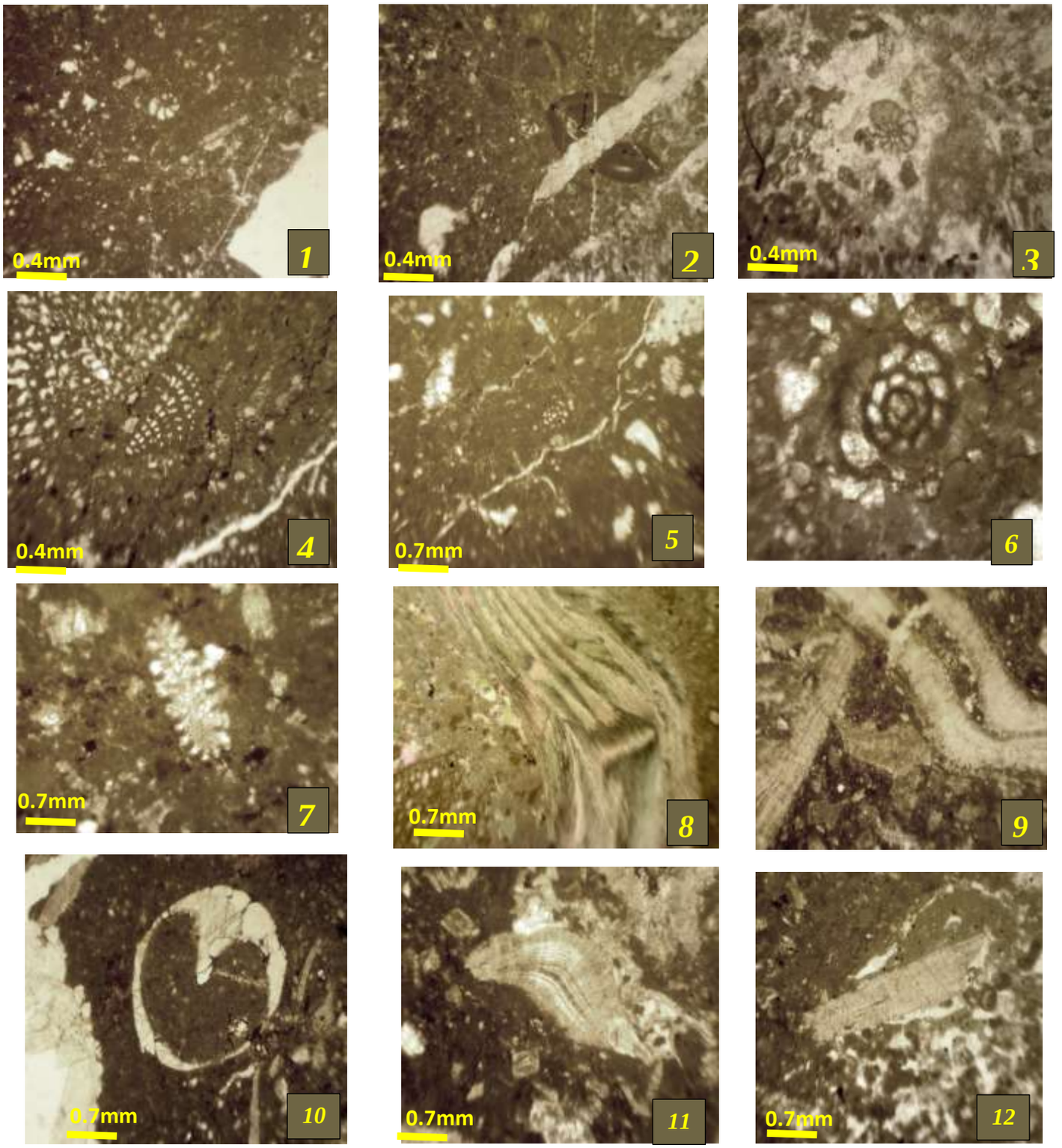
Plate –D-



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Conclusions

In present study Qamchuqa Formation include Upper and Lower Qamchuqa consist of limestone and dolomitic limestone they are separated by Upper Sarmord tangue which consist of shaley, marlly, dolomitic limestone, they deposited during Aptian -Albian within foot hill zone . This project involve biostratigraphy for three wells occur within Jambur oilfield Northeast of Iraq.

Thirty seven species of benthic foraminifra were distinguished, they are :

Mesorbitolina texana (Roemer, 1849), *Orbitolina* sp. , *Mesorbitolina sub concave* (Leymerie,1878), *Orbitolina sefini* Henson,(1948), *Simplorbitolina deltoidos* sp.nov., *Paleodictyoconus* sp.1,*Spiroloculina* sp., *Dictyoconus algeria*nus, *preachrysalidina* sp., *Nezzazata* picardi , *Nezzazata conica* (Smout) , *Quinqueloculina* sp. , *Triloculina* sp., *Nummoloculina* sp., *Nezzazata picardi* , *Nezazzata gyra* ,*Charentia cuvillieri* , *Spiroloculina* sp., *Miliolids* , *Dabarina hahouneresis, Chrysalidina* sp., *Praeorbitolina cormyi* , *Palorbitolina lenticularis Mesorbitolina parva* , *Simplorbitolina manasi* , *Iraqia simplex* (Hensun, 1948), *Paleodictyoconus arabicus* , *Quinqueloculina* , *Triloculina* sp. , *Spirolectammina* sp., *Textularia* sp.,*Nezazzata simplex* (Omara,1956), *Choffatila* sp., *Conulina pavonia*, *Charentia* spp.

In addition to following fossils that recognized in Qamchuqa Formation : Calcareous algae – *Coptocampylodon fontis*, Rudist fragments ,Pelecypods Gastropods , Mollusks , Brachiopods .Globigerina sp. , Ostracods shells , Echinoid fragmendes , Coral and Algea .

Five biozones were distinguished in Qamchuqa Formation depending on index fossil (*Orbitolina*) content, these zone are:

a: ***Praeorbitolina cormyi – Palorbitolina lenticularis*** **-** concurrent Zone (of Early Aptian).

b: ***Mesorbitolina parva*** **-** Range Zone (of Middle Aptian age)**.**

c: ***Mesorbitolina texana*** **-** Range Zone (of Late Aptian – Early Albian,).

d: ***Mesorbitolina subconcava*** - Range Zone (latest early Albian).

e: ***Orbitolina sefini*** - Range Zone (of Late Albian).

The age of the Qamchuqa Formation determined as(Aptian- Albian) depending on the above biozones of benthic foraminifra .

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Conflict of Interests.
There are non-conflicts of interest .

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الخلاصة

تكوين قمجوقة هو احد التكاوين التي ترسبت خلال العصر الطباشيري في العراق. حيث تم دراسة التكوين في(بئر جمبور-22 , جمبور -20, جمبور-15) الواقعة ضمن حقل جمبور النفطي شمال شرق العراق في محافظة كركوك. تم دراسة ثلاثة مائة وخمسة وثلاثون شريحة لتحديد المتحجرات و الانطقة الحياتية .تم تحديد سبعة وثلاثون نوع من اجناس الفورامنيفرا القاعية بالاضافة الى قطع من الرودست والبليسيبودا والمولاسكا و الاوستراكودا والطحالب والمرجان والاصداف وشوكيات الجلد. تم تحديد خمسة انطقة حياتية والتي من خلالها تم تحديد عمر التكوين و لذي يعود الى الابتيان-البيان.

الكلمات الدالة :- تكوين قمجوقة ، الطاباقية الحياتية، الفورامنفيرا، *الاوربيتولينا* ، جمبور-22.